beams. Each plan was delivered three times with the beam on time recorded for each beam. The maximum dose rate was 1400 monitor units per minute.

Results: When comparing dosimetric endpoints four treatment techniques without the inclusion of FFF, IMRT performed statistically better 2cc PTV maximum, 2cc body maximum and homogeneity index for the PTV compared to all other techniques. In general Organs at Risk (OAR) constraints were comparable between the conventional tangents, Field in field and hybrid IMRT techniques. VMAT performed statistically worse in several endpoints including both the point maximum and mean dose for the contralateral breast, Volume receiving 10Gy (V10) and 5Gy (V5) for the heart, ipsilateral and contralateral lung V5 and mean dose as well as the mean dose for combined lung compared to all other techniques planned.
There was no statistical difference for the V20 for the ipsilateral lung and combined lung for all techniques. When looking at the beam on time Hybrid IMRT(10.21s) had the quickest and VMAT(48.76s) the longest.
When comparing dosimetric endpoints four treatment techniques with the inclusion of FFF hybrid IMRT and FFF Hybrid IMRT performed statistically better for PTV2cc max, PTV homogeneity index, total body max and 2cc max. For all other OAR parameters tested in the investigated modulated techniques, treatment planning with FFF beams resulted in plans of equal quality compared with flattened beams. No significant differences were found. When looking at the beam on time FFF Hybrid IMRT(7.45s) had the quickest compared to current tangential delivery times (20.59s).

Conclusion: The inclusion of FFF beams and modulated techniques can significantly reduce treatment delivery times for left sided breast patients who are receiving (DIBH)

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Risk assessment of secondary cancer after craniospinal radiotherapy in childhood medulloblastoma

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Purpose or Objective: Primary central nervous system tumors represent the second most common neoplasms in childhood.The late effects, after radiation treatment (RT), develop gradually over several years, including neurocognitive deficiencies, cardiac toxicity, endocrinological problems, and secondary malignancies (SMNs).The incidence of SMNs is around 10–20%, 30 years after treatment. Predicting SMN risk, from the newer RT, techniques is difficult due to absence of epidemiological data, but mathematical models can be used. The aim of this paper is to determine possible dose-response relationships between radiotherapy dose and specific organs SMNs comparing conventional technique (3D-CRT) with IMRT delivered with Helical Tomotherapy (HT).

Material and Methods: In this work a dose-response relationship for malignant tumors is derived based on: the epidemiological data on cancer induction after Hodgkin's disease; from the data about cancer induction of the A-bomb survivor data("the linear-no-threshold model"). The data from two young patients, affected by medulloblastoma "standard risk"(female age 7y, male age 8y) treated at the National Cancer Institute in Aviano (Italy), were retrospectively analyzed using the Schneider's dose-response model for solid cancers induction (Theoretical Biology and Medical Modelling 2011). We calculated the impact of the different techniques on SMN induction risk, using organ equivalent dose (OED) calculated for a group of different dose-response models including a full model and linear model. The excess absolute risk (EAR/10000 pts-year) was considered for different organs at risk(OAR).

Results: The results demonstrated that the the linear model fits best colon, cervix and skin. Instead the full model fits all other organs, indicating that the repopulation/repair ability of tissue is neither 0 nor 100% but somewhere in between. We noted that soft tissue sarcoma fitted well by all the models and in the low dose range beyond 1 Gy the risk is negligible, but for increasing dose, sarcoma risk increases rapidly and reaches a plateau at around 25-30 Gy. From the analysis of the EAR breasts, we observed values of 11.5 in 3DCRT plan and of 43.9 in HT plan, respectively. This difference in EAR may be results due to missing of delineation of breast as OAR in pre-planning. The table n. 1 showed the EARk for each OAR in specific dose ranges, calculated for both treatment plans.

SITE	EAR 0-5 Gy		EAR 5-20 Gy		EAR 20-26 Gy	
	3DCRT	TOMO	3DCRT	TOMO	3DCRT	TOMO
Soft tissue	0,0012	0,008	0,57	0,5	2,3	2,2
Thyroid	5,7	9,02	11,5	11,2	0	0
Bladder	2,9	1,7	0	0	0	0
lung	3,4	9,5	29,4	21,5	38,3	38,4
Bone	0,00083	0,0035	0,47	0,26	0,78	0,79
Small Bowel	6,7	4,3	1,54	2,34	1,3	0
Skin *	0,5	1,9	15,6	10,4	24,2	25,1
Skin **	0,4	1,9	15,6	10,7	24,2	24,4

Conclusion: In this work OED for various OAR was calculated using different models and compared in two plans, in combination with epidemiological obtained absolute risk data. The models have taken into account also the age, important parameters in pediatric population. We think that, in the field of radiation therapy, estimated excess risk it may be interesting to know the advantage of different treatment techniques , in reference to the same organ and the same patient (sex ,age,exposure and expected years of life).

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Breast irradiation: Is the Isocenter fix ? Results of a Quality Control study.

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Purpose or Objective: The accuracy and reproducibility of tangential fields in breast cancer irradiation is crucial in the sense of tumor control. Small deviation in patient positioning can lead to geometrical miss and low doses in parts of the target as well as exposing OAR (i.e heart and lung) to high doses. Although portal imaging verification can reduce such errors, it is time consuming and could affect machine occupancy. Once the setup is performed in the first treatment it is possible to achieve reproducibility in the AP direction through SSD or couch vertical reading .The aim of this work was to test which of the two should be used in order to achieve better reproducibility through the treatment and whether the Isocenter is truly fixed during the treatment course.

Material and Methods: The study included 30 patients, treated between November 2014 and May 2015 at the ages 34 to 85, with an average age of 60. Total 634 portal images